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SUMMARY

In this study, a total of 150 random samples of egg-based desserts were collected from different bakeries, confectionary shops and retailers located in Assiut city. The egg-based desserts were represented as cream caramel, cream cakes, cakes (small and large scales) and biscuits (30 samples each). To assess their quality, samples were examined microbiologically for the incidence and counts of aerobic plate, thermotolerant, psychrotrophs, enterococci, coliforms, fecal coliforms, *E. coli*, *B. cereus*, *Staph. aureus*, yeasts and molds and anaerobes.

Part-I

Microbiological evaluation of the examined egg-based desserts samples

1- APC:

Aerobic bacteria were existed in 43.33%, 100%, 13.33%, 76.67% and 46.67% with an average of 6.8×10^3 , 3.9×10^5 , 5.3×10^2 , 3.9×10^4 and 8.3×10^3 cfu/g in the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

2- Thermotolerant count:

Thermotolerant bacteria could be detected in 16.67%, 56.67%, 13.33%, 43.33% and 16.67% with an average of 1.8×10^2 , 4.7×10^4 , 3×10^2 , 2.9×10^4 and 5×10^4 cfu/g in the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

3- Psychrotrophic count:

The obtained result revealed that psychrotrophic bacteria could be detected in 26.67%, 86.67%, 10%, 36.67% and 6.67% with an average of 1×10^4 , 5.3×10^4 , 1.7×10^3 , 1.9×10^3 and 3×10^2 cfu/g in the

examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

4- Enterococci count:

Enterococci bacteria were found in 40%, 3.33%, 13.33% and 6.67% with an average of 2.2×10^4 , 9×10^2 , 1×10^3 and 5.7×10^3 cfu/g in the examined samples of cream cake, cake (large scale), cake (small scale) and biscuit, respectively. No enterococci could be detected in the examined cream caramel samples.

5- Coliforms count:

Most probable number (MPN) techniques pinpointed that 23.33%, 93.33%, 3.33%, 30% and 23.33% of the examined cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit samples were contaminated with coliforms, respectively.

6- Fecal coliforms:

MPN techniques showed that 6.67%, 43.33%, 3.33% and 16.67% of the examined cream caramel, cream cake, cake (large scale) and cake (small scale) samples were contaminated with fecal coliforms, respectively. No fecal coliforms could be detected in biscuit samples.

7- *E. coli* count:

MPN techniques revealed that 20%, 3.33% and 3.33% of the examined cream cake, cake (large scale) and cake (small scale) were contaminated with *E. coli*, respectively. *E. coli* could not be detected in cream caramel and biscuit samples.

8- *B. cereus* count:

From the obtained results, it is found that 13.33%, 23.33%, 6.67%, 16.67% and 30% with an average of $<10^2$, 9.6×10^4 , 6.2×10^3 , $<10^2$ and 1×10^2 cfu/g in the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

9- *Staph. aureus* count

Staph. aureus were found in 43.33%, 53.33%, 3.33%, 13.33% and 36.67% with an average of 3.4×10^4 , 6.2×10^3 , $<10^2$, 1.9×10^4 and 1.2×10^4 cfu/g in the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

10- Yeasts and molds count

Fungi were detected in 53.33%, 96.67%, 16.67%, 60% and 70% with an average of 5.3×10^2 , 1.1×10^3 , 1.2×10 , 2.2×10^4 and 3.6×10^2 cfu/g in the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

11- Anaerobes

Anaerobic bacteria were detected in 16.67%, 80%, 40%, 73.33% and 70% of the examined samples of cream caramel, cream cake, cake (large scale), cake (small scale) and biscuit, respectively.

Part-II

Survival of inoculated microorganisms in prepared egg-based desserts

In this part of study, cream caramel and biscuits were prepared and inoculated with *B. cereus* and *Staph. aureus* for studying their survival behavior in the baking temperature. It was found that both *B. cereus* and *Staph. aureus* were not detected in prepared cream caramel samples. This indicating cream caramel is a product with a good keeping quality as the baking temperature at 180°C for 1 h is sufficient to get ride of both microorganisms. On the other hand, *B. cereus* only could be isolated from prepared biscuit samples in a number of $<10^2$ cfu/g. This could be attributed to the short time of baking temperature which may be insufficient to destroy the spores of this microorganism.

CONCLUSIONS

Food borne disease caused by microbiological hazards is a large and growing public health problem. During recent years, the reported incidences of food borne diseases have been significantly increased. The elderly and the immunosuppressed people as well as children are very susceptible to the health effects of food borne infections.

This study highlights the necessity to maintain hygiene practices at all stages throughout the food chain i.e. from manufacture to retail in order to minimize the food borne diseases problems.

The obtained results in this study proved that most of the examined cream cramel samples were of a quite good microbiological quality. However, some pathogenic microorganisms (*Staph. aureus*, *B. cereus*, coliforms and fecal coliforms) were existed in low counts that not sufficient to be a public health hazards except for *Staph. aureus*. The presence of *Staph. aureus* in unacceptable levels could be attributed to improper handling and delayed refrigeration.

Fortunately, most of the examined cream cake samples had acceptable numbers of aerobic plate counts. Low percentages of these samples had considerable numbers of thermodurics, psychrotrophes and enterococci. Also, they had low counts of coliforms, fecal coliforms and *E. coli* indicating their fecal contamination and presence of associated enteric pathogens. *Staph. aureus*, *B. cereus*, yeasts & molds and anaerobic bacteria were also existed in some of the examined cream cake samples but in high levels rendering them hazard for public health. According to the standards recommended by current public health guidelines for ready-to-eat foods sampled at the point of sale, most of the examined cream cake samples were satisfactory and acceptable. A considerable

numbers of cream cake samples were unsatisfactory and potentially hazards.

In case of large scale produced cakes, most of the examined samples were of a quite good microbiological quality. These findings encourage the importance for applying high industrial technologies to obtain high quality products.

Most of the examined small scale produced cakes were of a good microbiological quality. However, some pathogenic microorganisms (*Staph. aureus*, *B. cereus*, coliforms, fecal coliforms, *E. coli*, yeasts & molds and anaerobes) were mostly existed in low numbers that not sufficient to be of a public health concern.

Most of the examined biscuit samples contained acceptable level of aerobic bacteria, thermotolerants and psychrotrophes. Also, the majority of biscuit samples were contaminated by yeasts & molds and anaerobes. Acceptable levels of *Staph. aureus*, *B. cereus* and coliforms were existed. No fecal coliforms or *E. coli* were found in all of the examined samples.

Generally for production of high quality egg-based desserts, the following steps should be followed:

- 1- The design and facilities of food establishments producing the egg-based desserts should be in compliance with licensing requirements and conditions stated by the international standards.
- 2- Food establishments should have cleaning and sanitation programs to monitor and control all equipments, utensils and refrigeration units that have potential impacts on the safety of egg-based desserts products.
- 3- Adequate cleaning of piping bags that are re-used and of great concerns in the contamination of cream cakes should be provided.
- 4- Raw materials and ingredients (especially eggs) should only be obtained from reputable and approved sources.

5- Raw materials and ingredients delivered to a food premises should be inspected before acceptance.

6- Egg contents used in preparing desserts should be thoroughly evacuated to avoid contamination of products from their shells.

7- Personnel responsible for inspection should satisfy the following:

a) No signs of contaminations or damage to the raw materials and ingredients.

b) Chilled materials or ingredients have arrived at the proper temperature (4°C or below).

8- Packaging materials should be non-toxic and appropriate for each type of the egg-based dessert products. They should be stored and handled in clean and sanitary manner.

9- Food handlers should receive proper training in handling and preparing the product as well as personal hygiene to enable them to take precautions necessary to prevent contamination of the products.

10- Finished products prepared at room temperature should be cooled at 4°C or below within one hour.

11- Finished products should be labeled properly and the label should include a statement of storage conditions.

12- Finished products should be transported, distributed and displayed in a proper manner and at appropriate temperature to protect them from contamination and deterioration.

13- Appropriate and adequate chillers should be available in authorized retail outlets selling the products.

14- Clear instruction on the proper methods of storing, handling and displaying the products should be available and given to retailers.

15- A preventative food safety management system (such as the HACCP system) should be established to ensure that effective control measures are in place to minimize the potential chemical, physical or

microbiological contamination of the products during manufacturing process.